

LEAD SEAL CEMENTING TYPE CASING PATCH

Instruction Manual 6460



Lead Seal Cementing Type Casing Patch



NATIONAL OILWELL VARCO

One Company Unlimited Solutions

Lead Seal Cementing Type Casing Patch

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The designs and specifications for the tools described in this instruction manual were in effect at the time this manual was approved for printing. National Oilwell Varco, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change designs and specifications without notice or without incurring obligation.

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General Description

The **Bowen Lead Seal Cementing Type Casing Patch** is a tool which is made up to the upper casing string and permanently seals and cements to the lower string of tubing or casing in a single run. It incorporates the proven Bowen compression type multiple lead seal, combined with a cement valving feature which allows cementing in place immediately after the Patch is set. It eliminates the need for a circulating cementing valve or perforations near the Patch since the Valve is incorporated into the tool. The Patch becomes a permanent part of the well casing.

Use

The tool is used for replacing the upper portion of casing that has been previously cemented in place. It is suitable for wells which contain fluids or gases which are harmful to synthetic rubber seals. It is also useful because it combines the sealing and cementing operation, eliminating the time and inconvenience of doing the operation in two separate trips.

Construction

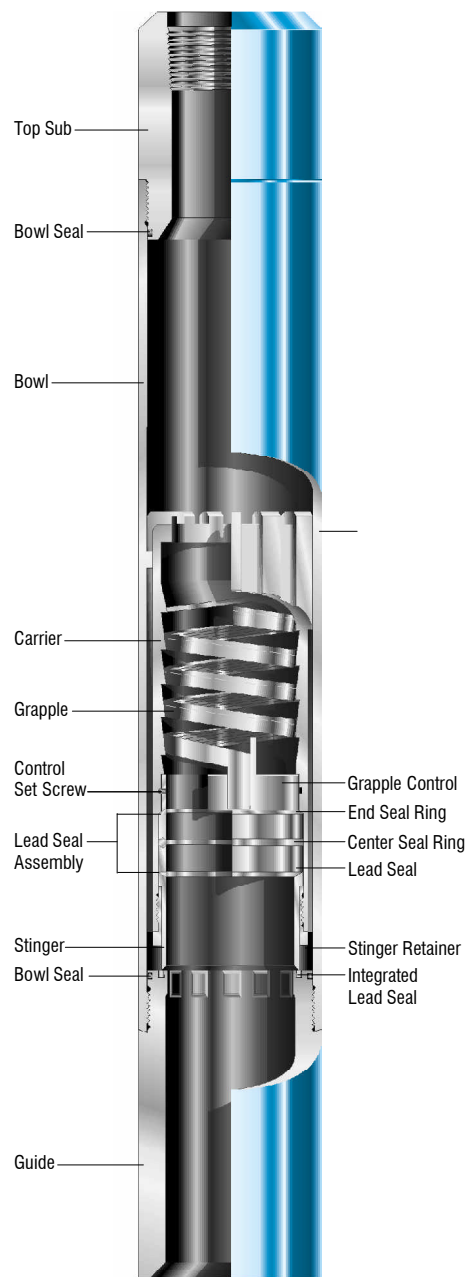
The tool's main parts consist of Top Sub, Bowl, Carrier, Grapple, Grapple Control with set screw, Lead Seal Assembly, Stinger, Stinger Retainer, Integral Lead Seal and Guide. Two Bowl Seals are installed at the threads of the Bowl where the Top Sub and Guide are made up. The Lead Seal Assembly consists of two Lead Seals separated by a Center Seal Ring with an End Seal Ring on each end. The Internal Lead Seal is installed in a groove on the top end of the Guide.

Explanation of Mechanism

The casing or tubing which is to be engaged in a lead sealing and cementing operation is referred to as the fish. The Carrier has external grooves for cement flow, a shoulder on the I.D. at the top, and threads at the bottom for the Stinger Retainer which is installed to retain the Grapple, Grapple Control, Lead Seal Assembly and Stinger. When the fish contacts the Carrier shoulder as the Patch is lowered, it moves up to the Top Sub as the fish is engaged. When the Patch is raised, the Top Sub, Bowl and Guide move up until the Stinger imbeds into the Integral Lead Seal in the Guide. This produces the pressure through the Stinger which collapses the Lead Seal Assembly onto the O.D. of the fish. By lowering the string then, the Stinger will move away from the Integral Lead Seal for circulation. The string is raised and the Stinger to Integral Lead Seal set again before cementing.

Operation

Prior to running the Lead Seal Cementing Type Casing Patch, the hole and the fish should be prepared, for patching operation. This is usually done by use of a suitable washover shoe and washover string. The main twofold purpose is to remove any existing cement, and resize the hole around the upper end of the fish; while simultaneously removing any burrs from the outside of the fish, and resize it as required. In addition to preparing the hole and fish O.D., a suitable bridgeplug or packer is usually set in the fish, near its upper end. This forms a temporary bridge to stop the cement. The bridgeplug or packer may be removed and the casing reamed after completion of patching and cementing operations.



**Bowen Lead Seal
Cementing Type Casing Patch**

The tool as assembled as outlined below. Check it over. Assemble the tool to the running string, and buck up tight.

CAUTION: Use tongs on Top Sub only; excessive crushing effort on Bowl will distort it, rendering it inoperative. Lower tool in hole until fish depth is reached. As the fish is reached, the running string should be slowly rotated to the right while lowering slowly. This combined lowering and rotational action is important to good operation. This should be continued until the fish contacts the shoulder at the upper end of the Carrier, and pushes it up till it "bottoms" against the Top Sub (Step 1, page 5). This can be determined by watching the weight indicator. Allow 15,000 to 20,000 pounds of weight to be supported by the Patch to assure good and complete engagement.

At this point pick string up to remove weight from Patch, while allowing torque to slack from running string.

CAUTION: Avoid any backlash.

Set the Lead Seals by elevating the running string (Step 2, page 5). The load required to set the Patch depends on size, and will vary from 10,000 pounds to 100,000 pounds or more. See accompanying setting load column of Calculated Strength Table on page 7.

At this point the Patch may be pressure checked with the mud pumps. Caution should be exercised, however, not to exceed a nominal 500 to 1,000 psi. Before applying any appreciable pressure, it is preferable to first reduce the setting load to a nominal 10,000 to 15,000 lb. load, or approximately one-fourth the original setting load, which-ever is smaller.

Having set the Lead Seals, and pressure checked them as described, the Casing Patch is again opened to circulation by lowering the running string slowly until all

string weight is equalized and approximately 15,000 to 20,000 lb. of weight is resting on the Casing Patch. This will again telescope the Carrier up against the Top Sub, while at the same time pulling the Stinger up off the Integral Lead Seal at the face of the Guide. Circulation through the Casting Patch may then be resumed.

After good circulation is established, the cementing cycle may be made (Step 3, page 5). When sufficient time has elapsed to position the cement column, stop circulation and again establish the seal by elevating the string until a pull load equal to the initial setting load is reached. The slips should be set and the applied load maintained during curing time required for the cement.

After the cement has cured, the excess cement may be drilled out, the plug removed, and the hole conditioned.

NOTES:

1. Care should be exercised during all stages of operation that the formation and Patch not be "slugged" or shock loaded with the mud pumps. This could be harmful to the formation and damaging to the tool.
2. If for any reason during operation it is desired to release and remove the Patch from the fish, proceed as follows: Bump down firmly until the top of the Carrier strikes the Top Sub. This will break the "freeze" between the Grapple and its fish, and also between the outside of the Grapple and the Carrier. After bumping down, slowly elevate the string while simultaneously rotating to the right. Continue this until the Patch is clear of the fish. It is important to elevate and rotate slowly simultaneously.

3. These Patches are designed to withstand pressures equal to the capacity of the running string, in most cases, and greater after cementing. Caution should be exercised, however, never to exceed the actual required pressures to perform necessary functions, until permanently cemented.

4. Extra long Guides are available on request to run, if more stabilizing length and greater cementing area are desired.

5. Spare parts are not normally required, since the Casing Patch becomes a permanent part of the well casing. Seals may be damaged in some cases, due to misrun or damage from a ragged fish, or change of plan after having been set. It is therefore recommended that one or two sets of Lead Seals be ordered extra, when the Casing Patch is to be used in remote locations.

Assembly

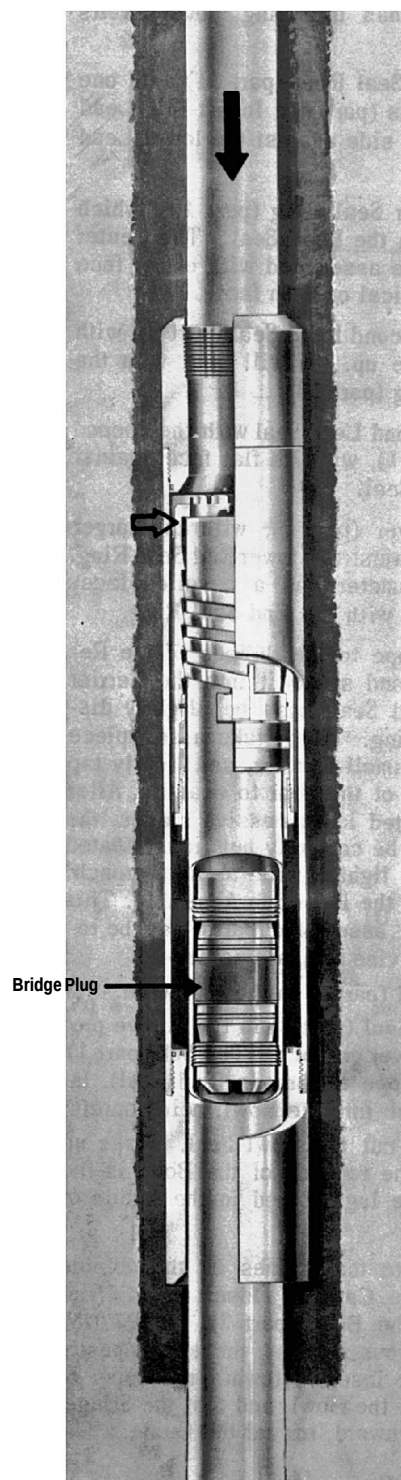
Refer to illustration on page 6.

The proper procedure for assembly is as follows:

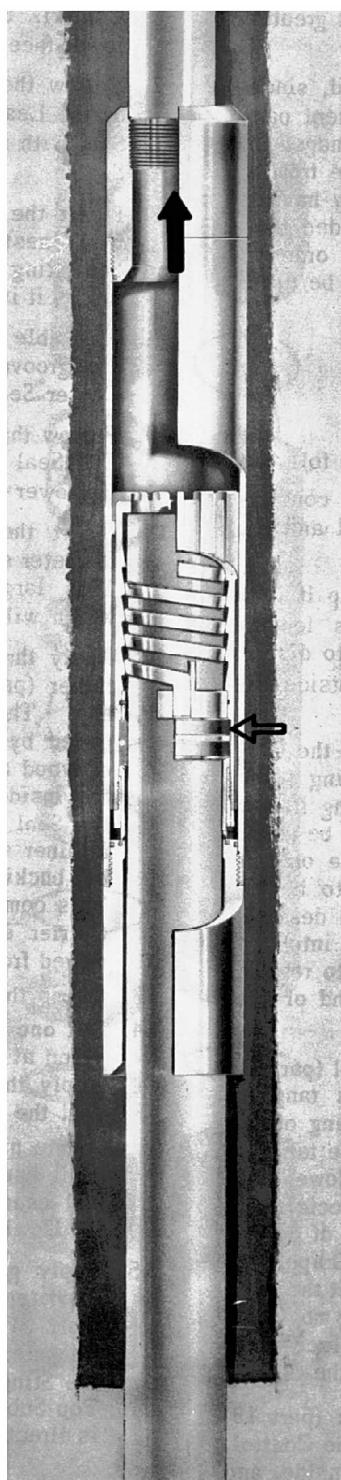
1. Begin with the Inner Sub Assembly, consisting of parts 3, 4, 5, 6, 7, 9, 10, 11 and 13. Clean all these parts thoroughly.
2. Take the Carrier (part 3) and clamp it in a pipe vise, near the center of its length.

CAUTION: Do not tighten enough to distort the Carrier or the slots on its outside diameter.

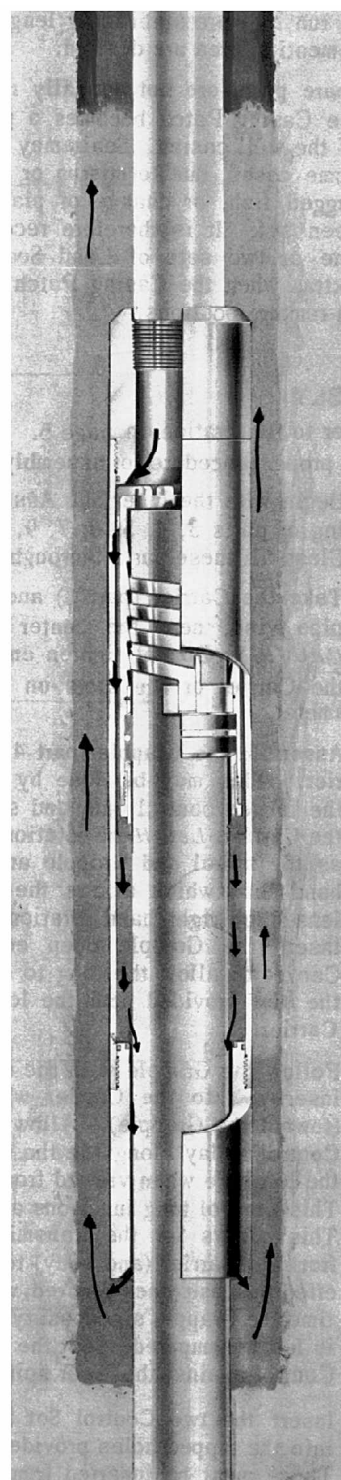
3. Assemble the Grapple (part 4), into the Carrier. This may be done by grasping it by the tanged control end, and screwing it into the Carrier. Left hand rotation must be used, as the spiral and Grapple are made on left hand



Step 1
Engage Fish and Bottom



Step 2
Set Lead Seal



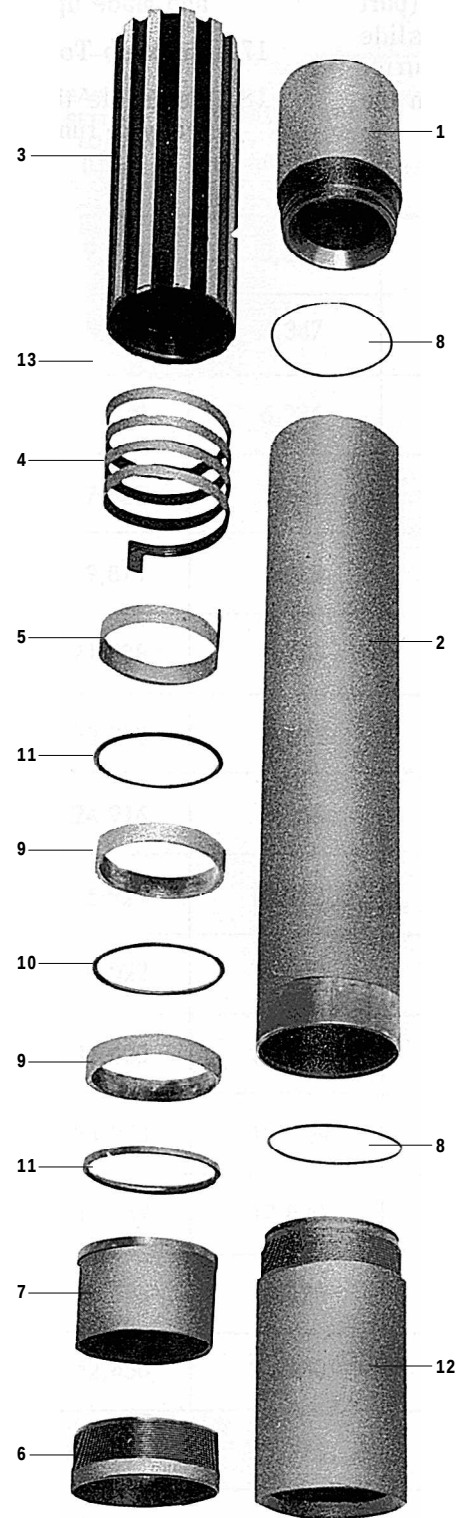
Step 3
Lower to Open and Cement

lead which allows the tool to be released by right hand rotation when desired. Insert the Grapple deep enough into the Carrier to allow the tang to come to rest in the slot provided near the lower end of the Carrier.

4. Follow the Grapple with the Control (part 5), inserted into the Carrier with its tang up (toward the Grapple). Allow the tang of the Control to lay alongside the Grapple tang, at the left side when viewed from the lower end. This Control tang functions as a special key. This allows for the transmission of torque from the Carrier (and body) to the Grapple, to effect release when desired, while at the same time the Grapple's necessary linear movement is left unhampered. Seat the upper face of the Control against the lower spiral in the Carrier.
5. Insert the two Control Set Screws (part 13) into the tapped holes provided in the Control. These must be inserted from the inside, and tightened down against the wall of the Carrier.
6. Insert one End Seal Ring (part 11) into the Carrier with the bevelled face against the Control, which has a mating bevel on its lower face.
7. Follow the End Seal Ring (part 11) with one of the Lead Seals (part 9). Insert this Lead Seal with its flat side against the lower Lead Seal.
8. Insert the Center Seal Ring (part 10), which will "nest" with the Lead Seal. The Center Seal Ring may be assembled with either face up, as it is identical on both faces.
9. Assemble the second Lead Seal (part 9), with the grooved side up. It will nest with the Center Seal Ring (part 10).

10. Follow this second Lead Seal with the second End Seal (part 11), with its flat face against the lower Lead Seal.
11. Insert the Stinger (part 7), with the larger diameter end against the lower End Seal Ring. This larger diameter has a bevelled face, which will mate with the End Seal Ring.
12. Apply thread dope to the threads of the Retainer (part 6) and screw it into the Carrier end. The Lead Seals may be slightly distorted by handling. If so, take a soft piece of wood and a small hammer, and lightly tap the inside wall of the Seal to seat it. After the Seal is seated in successive stages, the retainer should be carefully but firmly seated by bucking up lightly with a pipe wrench. This completes the inner Sub Assembly. This Carrier and its assembled parts may be removed from the vise and laid aside.
13. Clamp the Bowl (part 2) in the pipe vise.
14. Put one Bowl Seal (part 8) in the groove provided at the lower end of the Top Sub (part 1). Apply thread dope to threads (and Seal). Insert the Top Sub into the Bowl, being careful not to nick or cut the Bowl Seal. Make up until snug. The top end of the Bowl is the end nearest the lug located in the inside of the Bowl.
15. Apply grease to the splines on the outside diameter of the Carrier. Insert the Carrier (part 3) into the Bowl (part 2).

CAUTION: Be sure the cross-slots at the end opposite the Stinger are inserted toward the upper or Top Sub end of the Bowl, and that the Stinger is directed downward, toward the Guide.



NOTE: The Bowl has an integral lug type key in its I.D. One of the female splines at random, will mate with this key. The balance of these splines, collectively form adequate passage for the cement slurry. Before assembling the Guide (part 12) with the Bowl (part 2), reach into the Carrier, grasp it, and slide it back and forth, to assure that the Carrier is free to telescope up and down between the Guide and Top Sub, during operation.

16. The Guide (part 12) may then be assembled with the second Bowl Seal (part 8), and the Guide inserted into the lower end of the Bowl, and made up until shouldered.
17. Buck up Top Sub and Guide tight.
18. Assemble the tool to the running string. It is ready to run.

Calculated Strength Table - Lead Seal Cementing Casing Patches

Assembly No.	Casing Size	Lead Seal		Well Pressure		Well Pressure	
		Patch O.D.	Setting Load (Lbs.)	Working Load (40% Setting Load) (Lbs.)	To Burst W / Setting Load Applied	To Burst W / Working Load Applied	Pull To Burst Patch (No Well Pressure)
40514	2-3/8	4-1/8	9,141	3,656	12,094	12,691	120,391
41209	2-7/8	4-5/8	10,869	4,347	9,416	9,952	125,396
41210	3-1/2	5-1/4	15,839	6,336	6,673	7,205	135,165
40596	4	5-3/4	17,853	7,141	5,482	5,972	137,795
40619	4-1/2	6-1/2	19,871	7,948	4,418	4,872	135,943
40649	5	6-3/4	21,888	8,755	3,863	4,286	141,840
38179	5-1/2	7-7/16	23,912	9,565	3,033	3,429	133,786
41088	5-3/4	7-3/4	24,916	9,966	2,966	3,350	140,469
40679	6	8	25,929	10,372	2,758	3,130	141,217
40858	6-5/8	8-5/8	30,022	12,009	2,326	2,686	146,662
40859	7	9-1/8	31,620	12,648	2,362	2,707	161,482
40869	7-5/8	9-7/8	34,273	13,709	2,237	2,561	176,429
41004	8-5/8	11-1/8	44,549	17,820	2,202	2,529	224,349
41085	9-5/8	11-15/16	47,195	18,878	1,550	1,841	198,140
41086	10-3/4	13-5/8	52,450	20,980	1,835	2,101	269,178
41089	11-3/4	14-3/4	56,938	22,775	1,656	1,903	285,670
41087	13-3/8	16-5/8	95,652	38,261	1,580	2,550	396,488

Bowen Lead Seal Cementing Casing Patch

		2-3/8	2-7/8	3-1/2	4	4-1/2	5	5-1/2	5-3/4	6
O.D. of Casing										
O.D. of Patch		4-1/8	4-5/8	5-1/4	5-3/4	6-1/2	6-3/4	7-7/16	7-3/4	8
Complete Assembly	Part No.	40514	41209	41210	40596	40619	40649	38179	41088	40679
	Weight	102	131	143	156	217	224	261	258	273

Replacement Parts

Top Sub	Part No.	41092	41098	41104	41110	41116	41122	38415	41128	41134
	Weight	28	35	40	44	58	60	64	65	67
Bowl	Part No.	41093	41099	41105	41111	41117	41123	38416	41129	41135
	Weight	27	37	39	41	56	57	67	62	64
Guide	Part No.	41094	41100	41106	41112	41118	41124	38421	41130	41136
	Weight	27	34	36	38	50	51	64	68	71
Grapple Carrier	Part No.	41095	41101	41107	41113	41119	41125	38417	41131	41137
	Weight	12	17	19	21	40	41	50	51	53
Grapple	Part No.	17261	16143	26528	22403	13273	13283	12318	22413	13293
	Weight	3/4	1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-3/8	2-1/2
Grapple Control	Part No.	17262	16144	26529	22404	13274	13284	12319	22414	13294
	Weight	3/8	7/16	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
End Seal Ring (2 Req'd.)	Part No.	17265	16147	26532	22407	13277	13287	12322	22417	13297
	Weight	1/8	3/16	1/4	5/16	3/8	11/16	1/2	1/2	9/16
Center Seal Ring	Part No.	17266	16148	26533	22408	13278	13288	12323	22418	13298
	Weight	1/8	3/16	1/4	5/16	3/8	7/16	1/2	1/2	5/8
Packer Stinger	Part No.	41096	41102	41108	41114	41120	41126	38420	41132	41138
	Weight	2	2-1/4	2-1/2	2-3/4	3	3	3-1/2	3-1/2	4-3/4
Stinger Retainer	Part No.	41097	41103	41109	41115	41121	41127	38419	41133	41139
	Weight	2-1/2	2-3/4	3	3-1/4	3-1/2	3-1/2	4	4	4-1/4
Control Set Screw (2 Req'd.)	Part No.	12329	12329	12329	12329	12329	12329	12329	12329	12329
	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Lead Seal (2 Req'd.)	Part No.	17264	16146	26531	22406	13276	13286	12324	22416	13296
	Weight	1	1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-3/8	2-5/8
Bowl Seal (2 Req'd.)	Part No.	30-15	30-18	30-24	30-28	30-33	30-36	30-38	30-40	30-41
	Weight	1/50	1/50	1/50	1/50	1/50	1/50	1/50	1/50	1/50

How To Order:

- Specify: (1) Name & Number of Assembly or Part.
 (2) Casing O.D.
 (3) Size & Type of Thread.

Prices will be quoted on request.

Completely "left hand" tools or tools with left hand threads are available on request.

Seal Assemblies suitable for service from 550°F. to 750° F temperature range are available, where required.

Bowen Lead Seal Cementing Casing Patch (Continued)

O.D. of Casing		6-5/8	7	7-5/8	8-5/8	9-5/8	10-3/4	11-3/4	13-3/8
O.D. of Patch		8-5/8	9-1/8	9-7/8	11-1/8	11-15/16	13-5/8	14-3/4	16-5/8
Complete Assembly	Part No.	40858	40859	40869	41004	41085	41086	41089	41087
	Weight	285	337	379	507	717	816	956	1363

Replacement Parts (Continued)

Top Sub	Part No.	41140	41146	41152	41158	41164	41170	41176	41185
	Weight	71	88	98	150	220	195	240	280
Bowl	Part No.	41141	41147	41153	41159	41165	41171	41177	41182
	Weight	67	82	98	112	187	235	260	310
Guide	Part No.	41142	41148	41154	41160	41166	41172	41178	41184
	Weight	72	75	80	125	165	208	255	360
Grapple Carrier	Part No.	41143	41149	41155	41161	41167	41173	41179	41183
	Weight	55	70	78	90	105	130	175	350
Grapple	Part No.	13303	12503	13073	13313	12478	13323	20858	18448
	Weight	2-5/8	2-3/4	3	4	5-1/8	6-1/2	7-3/4	9
Grapple Control	Part No.	13304	12504	13074	13314	12479	13324	20859	18449
	Weight	1-3/8	1-1/2	1-7/8	2-1/4	2-5/8	3	3-1/2	4
End Seal (2 Req'd.)	Part No.	13307	12507	13077	13317	12482	13327	20862	18452
	Weight	9/16	5/8	5/8	3/4	13/16	7/8	15/16	1
Center Seal Ring	Part No.	13308	12508	13078	13318	12483	13328	20863	18453
	Weight	3/4	1	1-3/16	1-1/2	1-5/8	1-3/4	1-7/8	2
Packer Stinger	Part No.	41144	41150	41156	41162	41168	41174	41180	41186
	Weight	4	4-1/4	5	8	11	15	19	21
Stinger Retainer	Part No.	41145	41151	41157	41163	41169	41175	41181	41187
	Weight	4-1/2	4-3/4	5-1/2	9	10	11	12	14
Control Set Screw (2 Req'd.)	Part No.	12329	12329	12329	12484	12484	12484	12484	12484
	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Lead Seal (2 Req'd.)	Part No.	13306	12506	13076	13316	12481	13326	20861	18451
	Weight	3	3-1/2	3-3/4	4-1/8	4-1/2	4-7/8	5-3/8	6
Bowl Seal (2 Req'd.)	Part No.	30-43	30-45	30-48	27-76	27-77	27-82	27-80	27-86
	Weight	1/50	1/50	1/50	1/25	1/25	1/25	1/25	1/25

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* Denotes Manufacturing and Engineering facilities

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

Lifting and Handling Solutions

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions

Well Service and Completion Solutions